"SYNTHESIS, PHYSICOCHEMICAL, SPECTROSCOPIC AND BIOLOGICAL STUDIES OF SOME NEW 'd' BLOCK METAL COMPLEXES"

SYNOPSIS

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By

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"SYNTHESIS, PHYSICOCHEMICAL, SPECTROSCOPIC AND BIOLOGICAL STUDIES OF SOME NEW 'd' BLOCK METAL COMPLEXES"

1. Abstract of proposed work plan/problem

'd' block metal ions with multidentate organic ligands have experimentally demanding, most intellectual, attractive and an important class of nitrogen donor ligands and occupy prominent position in the field of coordination chemistry. Metal complexes are also known as coordination compounds, which include all metal compounds. Metal complex is a structure consisting of a central metal ion or atom bonded with anions (ligands). Compounds that contain a coordination complex are called coordination compounds.

Chemical investigations on metal complexes of naturally occurring ligand systems and their importance in biology and medicine constitute one of the most interesting and experimentally demanding area of modern coordination chemistry. Biochemical activity of many organic compounds are known to be associated with their ability to form complexes with various inorganic species including metal ions. However, synthesis, characterization and biological studies of metal complexes of synthetic analogues of many drugs have not received as much attention as they deserve.

The metal complexes will be prepared by different methods. New 'd' block metal complexes have been synthesized and characterized on the basis of analytical and physicochemical and spectroscopic studies. The ligand forms metal complexes with 'd' metal ions viz. Cr(III), Mn(II), Fe(III), Co(II), Ni(II), Cu(II), Zn(II)etc. Thermogravimetric studies were carried out to identify the decomposition pattern and hence the stoichiometry as well as the geometry of the metal complexes. Ligands and their metal complexes were screened for their biological activity. The antibacterial and antifungal activity of the newly synthesized ligands and their metal complexes were tested on bacteria. In our studies we will conducted some microbial experiments to see whether ligands and complexes have any action on microbial activities.

2. Review Literature and Development in the Subject: (Previous work done in the related area):

Recently, there has been considerable interest in chemistry of the metal complexes of containing O, N, and S donors

The increased activity in this field may be attributed to the striking structural features and reported antimicrobial activity of these donor ligands and the complexes derived from them.

Chelating ligands containing O, N, and S donor atoms show broad biological activity and are of special interest because of the variety of ways in which they are bonded to metal ions. It is known that the

existence of metal ions bonded to biologically active compounds may enhance their activities.

Obaleye J.A. et al reported synthesis of some copper(II), cobalt(II), nickel(II) and iron(III) complexes of norfloxacin and ofloxacin are reported here. Their structures were elucidated by elemental analysis, ultraviolet and infrared spectroscopy, it was observed from the study that nofloxacin and ofloxacin molecule coordinated to metals through the two oxygen of the 3 carboxlate and 4-keto groups. Antimicrobial and toxicological studies carred out on some of the products showed a level of antimicrobial activity and toxicity comparable with their respective parent drug.

This paper presents the structure and antibacterial properties of some complexes of Co(II), Ni(II), Cu(II), and Zn(II) with a novel Schiff base obtained from 4-Methyl, 7-hydroxy, 8-formyl coumarin and N-methylamino propylene diamine. The Schiff base was characterized by Physical, spectral and analytical data. The synthesized Schiff base act as bidentate ligand for the complexation reaction with Cu(II), Ni(II), Co(II) and Zn(II) ions. The structure of each complex was characterized by spectroscopic methods (IR, UV-Vis, IH-NMR, and Mass spectroscopy) and elemental analysis. Molecular weight of few metal complexes was confirmed by high resolution mass spectroscopy. According to these data, we propose an octahedral geometry for Co(II), Ni(II), Zn(II) and Cu(II) complexes. Antibacterial activity of the ligand and its complexes were tested against selected bacteria. The ligand and all the complexes posses antimicrobial and antifungal activity. The transition metal complexes have shown superior antimicrobial and antifungal activities as compared to Schiff base ligand.

7-(R)-2-Amino-2-(4-hydroxyphenyl)acetamido]-3-methyl-3cephem4-carboxylic acid monohydrate (AMCC) is a active chelating agent due to presence of different donor atoms. When this chelating agent is treated with Fe^{2-}, Co^{2-} and Cu^{2-} metal ion solution at specific pH it produces different metal ion complexes, after purification they were characterized by physical and chemical methods. To determine the nature of bonding in the complexes infrared, UV-Visible spectra were used. TGA-DTA gives information regarding effect of temperature in the decomposition of complexes. XRD and other parameters are used for determining probable geometry of metal complexes.

Thiosemicarbazones are highly reactive compounds which form chelate complexes with metal ions. There are many complexes with chelates of sulphurand nitrogen as donor atoms.

All newly heterocyclic base adducts of cobalt(II) complexes were synthesized by the reaction of cobalt(II) chloride with 5-Chloro-2-hydroxy acetophenone in presence of heterocyclic base like pyridine (py), 2,2' bipyridine (bipy), 1,10-phenanthroline (Phen), α/β-picoline.

They were characterized by 13C, 1H NMR as well as IR, electronic spectra. The thiosemicarbazone and its cobalt(II) complexes exhibit good antimicrobial as well as antioxidant activity.

3. Objectives of Research/Proposed hypothesis:

- To synthesis of ligands and their metal complexes.
- To Characterize synthesized ligands and their metal complexes by using physicochemical and spectroscopic studies, magnetic moments and molar conductance.
- To study the coordination modes of ligands and their metal complexes by using physicochemical methods like elemental analysis; M:L ratio, conductance measurement magnetic moments Thermogravimetric analysis and different spectroscopic studies like UV-VIS, IR, XRD. To know the geometry of complexes.
- In order to check the biological activities of the ligands and their metal complexes, we have planned to conduct antibacterial, antifungal studies.

4. Methodology to be adopted:

At the time of Synthesis known and new methods, which will be used during investigations, can be specified as:

(a) Elemental analysis, thermal analysis, spectral techniques i.e. I.R. UV-Vis, XRD etc. will be used for identification and characterization of ligands and complexes.

(b) The magnetic moment studies will be used to characterize the electronic state of the metal in complex.

(c) The microbial study will be carried out to assess the medicinal values of the complexes.

5. Importance of Study/Society applications:

In the proposed work we have synthesized new series of ligands and metal complexes. The ligands which are synthesized or purchased from market can be used to synthesize metal complexes with other transition metals also. So it is of great biological importance. The transition metal complexes play an important role in cancer therapy and molecular biology.

- International Status:

  International Symposium on Metal Complexes (ISMEC 2017) Which is held in Dijon, France from the 11^{th} to the 15^{th} June 2017.

  ISMEC has become years after years a well-established series of international conferences focusing on the study and applications of metal complexes in the fields of analytical, biomedical, environmental, supramolecular, inorganic, physical and industrial chemistry.

- National Status:
  Previous and recent researches have shown a tremendous success int eh use of metal complexes particularly the transition metal complexes in the treatment of many diseases, cancer leukemia are reported. Potential metal-antibiotic drugs and some cosmetics were focused in line with application of biocoordination chemistry which appears to be crucial for improving the design of compounds to reduce toxic side effects and understand their mechanisms of action.
- Importance:
  Metal ion plays important role in biology which has lead to the development of huge number of metal complexes with diverse therapeutic activity. The advances in the field of chemistry provide better opportunities to use metal complexes as therapeutic agents. Cisplantin, carboplantin and oxaliplantin are the well known metal based drugs widely used in the treatment of cancer. Besides these complexes other metal complexes have shown promising results in the treatment of diseases like diabetes, ulcer, rheumatoid arthritis, inflammatory and cordivascular diseases etc. this review includes the application of some potential metal complexes in the treatment of various diseases/disorders to improve the therapeutic efficacy of the pharmaceuticals. Cardiovascular diseases etc. this review includes the application of some potential metal complexes in the treatment of various diseases/disorders to improve the therapeutic efficacy of the pharmaceuticals.

6. Proposed work plan / Formulation and Structure of Study:

Time Plan for these studies is proposed as

(a) First six month of compulsory course work as per the University regulation and referencing to survey the present research work to develop new ideas in the field.
(b) Synthesis, Purification and Characterization of ligands – six months
(c) Synthesis of complexes of ligands with few metal ions – six months
(d) Purification and Characterization of complexes – six months
(e) Microbial investigations on complexes – three months
(f) Literature survey – three months
(g) Writing of thesis – six months

Visits to other laboratories will be made for different types of studies wherever required.

Research Scholar	**Research Guide**
Mr. Kapil Totawar	**Dr. L.P. Shinde**